

Missouri Longitudinal Joint Construction

403.16 Joints. Transverse joints shall be formed by any method that will produce a dense, vertical section for use when laying is resumed. When a transverse vertical edge is to be left and opened to traffic, a temporary depth transition shall be built as approved by the engineer. The joint formed when the fresh mixture is placed shall be dense, well sealed, and the grade, line and surface texture of the succeeding surface shall conform to that of the joined surface. If directed by the engineer, the transverse joint shall be painted with a light coating of liquid asphalt. Hand manipulation of the mixture shall be minimized to avoid unsightly surface texture.

403.16.1 Joint Composition. Longitudinal joints shall be formed by the use of an edging plate fixed on both sides of the finishing machine. Care shall be taken to obtain a well bonded and sealed longitudinal joint by placing the hot mixture in a manner ensuring maximum compaction at this point. If directed by the engineer for properly sealing the longitudinal joint, a light coating of bituminous material shall be applied to the exposed edge before the joint is made. The minimum density of all traveled way pavement within 6 inches of a longitudinal joint, including the pavement on the traveled way side of the shoulder joint, shall not be less than 2.0 percent below the specified density when unconfined. The density of the longitudinal joint when confined will be included in the evaluation of the remainder of the mat. Each side of the joint shall be flush and along true lines.

403.16.2 Joint Offset. The longitudinal joint in any layer shall offset that in the layer immediately below by a minimum of 6 inches; except, the joints in the completed surfacing shall be at the lane lines of the traveled way or other required placement width outside the travel lane. The placement width shall be adjusted such that pavement marking shall not fall on a longitudinal joint.

403.23.6 Density Adjustment. Pay adjustments due to longitudinal joint density will apply to the full width of the lane paved. The average of joint cores from each lot will determine specification compliance. Adjustments will be in accordance with [Sec 403.23.7.4.1\(b\)](#). If payment reductions are necessary, the lower adjusted contract unit price of the PWL or unconfined joint density adjustment will apply. Adjustments due to joint density will apply to the lot from which the cores are obtained.

403.23.7 Percent Within Limits. PWL will be based on the mean, standard deviation and quality index of each lot's test results. The upper PWL (PWL_u) and lower PWL (PWL_l) is determined from the table in [Sec 502.15.8](#). Total percent within limits, PWL_t , is: $PWL_t = (PWL_u + PWL_l) - 100$.

The mean is: $x_a = (\sum x_i)/n$

Where: x_a = Average of the individual values being considered

$\sum x_i$ = The summation of all the individual values being considered

n = The number of individual values under consideration

The Standard Deviation is: $s = (\sum(x_i - x_a)^2/(n - 1))^{1/2}$

The Upper Quality Index is: $Q_u = (USL - x_a)/s$

The Lower Quality Index is: $Q_l = (x_a - LSL)/s$

Where: Q_u = Upper Quality Index

Q_l = Lower Quality Index

USL = Pay Factor Item Upper Spec Limit

LSL = Pay Factor Item Lower Spec Limit

403.23.7.1 Quality Level Analysis. The engineer will make the QLA no more than 24 hours after receipt of the contractor's test results, by determining the PWL_t for each designated pay factor item.

403.23.7.1.1 Acceptance. The contractor's test results will be used when applicable to determine the PWL, provided the contractor's QC tests and the engineer's QA tests compare favorably, and provided the engineer's inspection and monitoring activities indicate the contractor is following the approved QC Plan.

403.23.7.1.2 Comparison. Favorable comparison will be obtained when the engineer's QA test results on a production sample are within two standard deviations, or one-half the specification tolerance, whichever is greater, from the mean of the contractor's test results for that particular lot.

403.23.7.1.3 Outliers. No test result shall be discarded, except individual test results on a lot basis may be checked for an outlier in accordance with the statistic T in ASTM E 178, at a significance level of 5 percent. If an outlier is found, material from the retained QA sample may be tested, in the presence of the engineer, to determine a replacement test value. The replacement test value shall be used in the PWL determination.

403.23.7.1.4 Roadway/Shoulder Lots. For the purpose of QLA, mixture placed on the traveled way and placed on the traveled way and shoulders integrally, shall be accounted for in a regular lot/sublot routine. Mixture placed on shoulders only shall be accounted for in a shoulder lot/sublot routine.

403.23.7.1.5 Random Sampling. For the purpose of QLA, all mixture placed on the roadway shall be subject to random testing, except mixture placed within 6 inches of an unconfined longitudinal joint shall not be subject to evaluation. Random samples taken in the same day may be separated by 200 tons.

403.23.7.2 Pay Factors. The total pay factor (PF_T) for each lot will be equal to the weighted sum of the pay factors (PF) for each pay factor item for each lot, and is determined as follows:

$$PF_T = + (0.25) PF_{\text{density}} + (0.25) PF_{AC} + (0.25) PF_{VMA} + (0.25) PF_{Va}$$

The PF_T for each lot, on the shoulder or otherwise when the density pay factor is not directly included, will be equal to the weighted sum of the PF for each pay factor item for each lot, and will be determined as follows:

$$PF_T = + (0.3333) PF_{AC} + (0.3333) PF_{VMA} + (0.3333) PF_{Va}$$

The PF for each pay factor item for each lot will be based on the PWL_t of each pay factor item of each lot and will be determined as follows:

$$\begin{aligned} \text{When } PWL_t \text{ is greater than or equal to } 70: PF &= 0.5 PWL_t + 55 \\ \text{When } PWL_t \text{ is less than } 70: PF &= 2 PWL_t - 50 \end{aligned}$$

403.23.7.2.1 Density Pay Factor. The theoretical maximum specific gravity of the mixture, as determined for each subplot and the bulk specific gravity of no less than one core from each subplot, will be used to perform the QLA for the percent of theoretical maximum density. Thick cores required to be cut in half in accordance with [Sec 403.15.4](#) shall effectively double the number of sublots for cores. When density is not used as a pay factor, additional adjustment of the contract unit price will be based on the table in [Sec 403.23.7.4.1\(b\)](#).

403.23.7.2.2 Asphalt Content Pay Factor. The QLA will be performed using the asphalt content test results from each lot.

403.23.7.2.3 Voids in the Mineral Aggregate and Air Voids Pay Factor. Two gyratory specimens shall be compacted for each subplot and the average of the two specimens will be used to calculate the volumetrics of the subplot. The VMA, VFA, and air voids shall be determined from the gyratory compacted specimens. The VMA and air voids for the QLA shall be those calculated using the combined bulk specific gravity of the aggregate as listed on the approved job mix formula, the average bulk specific gravity of the gyratory compacted specimens and the theoretical maximum specific gravity of the mixture determined for the subplot of material. The aggregate content used for the calculation shall be that determined from field asphalt content testing for that subplot.

403.23.7.3 Removal of Material. All lots of material with a PFT less than 50.0 shall be removed and replaced with acceptable material by the contractor. Any subplot of material with a percent of theoretical maximum density of less than 90.0 percent or greater than 98.0 percent shall be removed and replaced with acceptable material by the contractor. For SMA mixtures, any subplot of material with a percent of theoretical maximum density of less than 92.0 percent shall be removed and replaced with acceptable material by the contractor. Any subplot of material with air voids in the compacted specimens less than 2.5 percent shall be removed and replaced with acceptable material by the contractor. No additional payment will be made for such removal and replacement. The replaced material will be tested at the frequencies listed in [Sec 403.19](#). Pay for the material will be determined in accordance with the applicable portions of [Sec 403.23](#) based on the replacement material.

403.23.7.4 Miscellaneous Applications.

403.23.7.4.1 Small Quantities. Small quantities are defined in [Sec 403.19.3.2.1](#). Unless the contractor has elected to use the normal evaluation in the Bituminous QC Plan for small quantities, the following shall apply for each separate mixture qualifying as a small quantity:

(a) QLA and PWL will not be required.

(b) Mixtures shall be within the specified limits for VMA, Va, AC and density. In addition to any adjustments in pay due to profile, the contract unit price for the mixture represented by each set of cores will be adjusted based on actual field density above or below the specified density using the following schedule:

Field Density (Percent of Laboratory Max. Theoretical Density)			Pay Factor (Percent of Contract Unit Price)
For all SP mixtures other than SMA:			
		92.0 to 97.0 inclusive	100
97.1 to 97.5	or	91.5 to 91.9 inclusive	90
	or	91.0 to 91.4 inclusive	85
97.6 to 98.0	or	90.5 to 90.9 inclusive	80
	or	90.0 to 90.4 inclusive	75
Above 98.0	or	Below 90.0	Remove and Replace
For SMA mixtures:			
		>94.0	100
		93.5 to 93.9 inclusive	90
		93.0 to 93.4 inclusive	85
		92.5 to 92.9 inclusive	80
		92.0 to 92.4 inclusive	75
		Below 92.0	Remove and Replace